

Independent claim 3 recites a semiconductor device comprising a substrate, and an insulating film of a fluorine-contained carbon film formed on the substrate. The surface of the insulating film is irradiated with hydrogen plasma. The semiconductor device also includes a wiring layer of copper formed on the insulating film, and an adhesion layer formed between the insulating film and the wiring layer, for preventing the wiring layer from being peeled off from the insulating film. The adhesion layer includes a metal layer of a metal, and a layer of a compound containing carbon and the metal.

Yan relates to an apparatus for etching an organic anti-reflective coating (OARC) layer and a titanium nitride anti-reflective coating (TiN ARC) layer deposited on a substrate located within a processing chamber. Yan discloses a substrate 100 including a base 110, made of any material, such as semiconductor, glass, ceramic, metal, or polymer. The base 110 is preferably a semiconductive wafer, such as a silicon wafer. A plurality of layers are formed on the base 110, including the following: an underlying layer 114 formed of an insulative oxide layer such as a silicon oxide layer; an overlying layer 116 forming a base diffusion barrier of titanium, tungsten, titanium-tungsten, titanium nitride, or a combination of these; a middle layer 117 forming a conductive layer of an alloy of aluminum, silicon, and copper; a titanium nitride anti-reflective coating (TiN ARC) layer 118; a top organic anti-reflective coating (OARC) layer 120, which could be a carbon containing material, such as a polymeric material; and a resist layer 122 which is resistant to etching, such as photoresist. See Yan, column 5, lines 19-52.

The OARC layer 120 and the TiN ARC layer 118 are etched with a first single stage step. This is accomplished by introducing an etchant gas into the process zone,

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and generating a plasma from the etchant gas. The plasma etches both the OARC and TiN ARC layers on the substrate. See Yan, column 4, lines 5-24; column 8, lines 8-10.

However Yan fails to disclose many of the elements recited in independent claim 3. For example, Yan fails to disclose an insulting film of a fluorine-contained carbon film, an insulating film having a surface irradiated with hydrogen plasma, and an adhesion layer that includes a metal layer of a metal and a layer of a compound containing carbon and the metal.

The claimed invention recites an insulating film of a fluorine contained carbon film. Yan discloses a silicon oxide insulative layer as the underlying layer 114. See Yan, column 5, lines 33-34. The Examiner indicated that the OARC layer 120 could be the insulating film. See Office Action, page 3. Yan does disclose that the OARC layer 120 could be of a carbon containing material. See Yan, column 5, lines 29-31. Although the OARC layer can be of a carbon containing material, Yan does not disclose a fluorine-contained carbon film, as recited in claim 3.

Additionally, Yan fails to disclose an insulating film having a surface irradiated with hydrogen plasma. Yan discloses etching of the OARC layer 120 and the TiN ARC layer 118, thereby fully removing the layers. See Yan, column 4, lines 5-11; FIGs. 1 and 2. In the present invention, an irradiated surface is a surface treated to alter the atomic composition of the surface. See Specification, page 7, lines 6-18. Yan does not disclose any layer having a surface irradiated with hydrogen plasma, and further does not disclose an insulating film of a fluorine contained carbon film wherein the surface is irradiated with hydrogen plasma, as recited in claim 3.

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Finally, Yan fails to disclose an adhesion layer that includes a metal layer of a metal and a layer of a compound containing carbon and the metal, as recited in independent claim 3. The Examiner indicated in the Office Action that the TiN ARC layer 118 is the claimed metal layer. See Office Action, page 3. However, the TiN ARC layer 118 cannot be the claimed metal layer because Yan does not disclose the TiN ARC layer as having more than a single composition. Therefore, the TiN ARC layer cannot be the claimed adhesion layer, which includes a metal layer of a metal and a layer of a compound containing carbon and said metal.

Yan fails to disclose many of the recited features of independent claim 3. Accordingly, independent claim 3 is not anticipated by Yan. Applicant respectfully requests that the Examiner reconsider and withdraw this rejection.

Claims 4, 5 and 10 depend from and add additional features to independent claim 3. Accordingly, these claims are not anticipated for at least the reasons set forth above. Applicant respectfully requests that the Examiner withdraw this rejection.

Rejection under 35 U.S.C. § 103

The Examiner rejected claims 6-9 under 35 U.S.C. § 103 as being unpatentable over Yan. Claims 6-9 depend from and add additional features to independent claim 3. Accordingly, claims 6-9 are not unpatentable for at least the reasons set forth above. Applicant respectfully requests that the Examiner withdraw this rejection of claims 6-9.

Conclusion

In view of the foregoing remarks, Applicant submits that the claimed invention is neither anticipated nor rendered obvious in view of the prior art reference cited against this application. Applicant therefore requests allowance of the pending claims.

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Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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